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TITLE OF INVENTION

CONSTRUCTION AND METHOD IN ELECTRIC MOTOR DRIVE

APPLICANT(S) FOR DO/EO/US

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Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☒ is attached hereto (required only if not communicated by the International Bureau).
  - b. ☐ has been communicated by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
  - a. ☐ is attached hereto.
  - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
  - b. ☐ have been communicated by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
14. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
15. ☒ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items or information:  
PCT/ISA/210 (English)  
PCT/RO/101 (English)

21. ☒ The following fees are submitted:**BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):**Neither international preliminary examination fee (37 CFR 1.482)  
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1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

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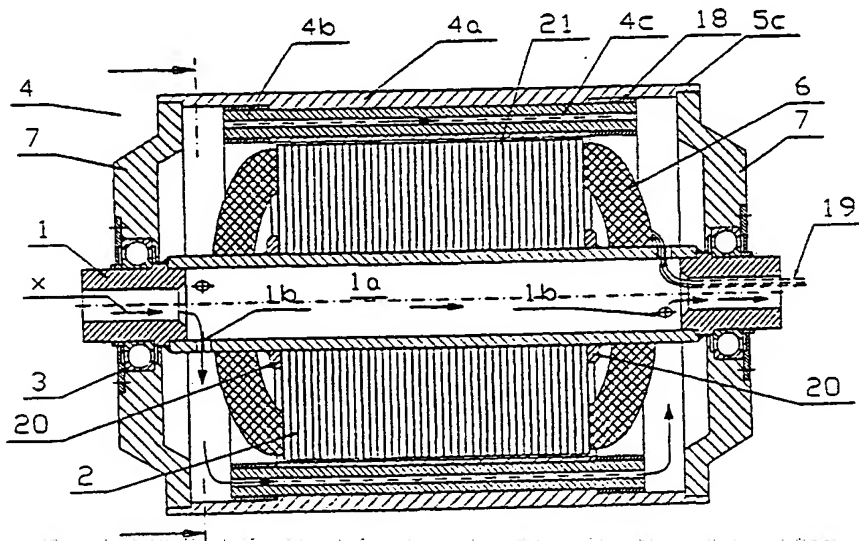
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(54) Title: CONSTRUCTION AND METHOD IN ELECTRIC MOTOR DRIVE



(57) Abstract: The object of this invention is the construction in electric motor drive, where a asynchronous motor, such as drum motor, which has a stator (2) mounted on a non-rotatory shaft (1) and has rotatory, like by means of bearings (3), connected rotor (4), is arranged to drive the machine construction (actuator). The rotor (4) of the asynchronous motor conveyor's is arranged to be directly a functional part of the machine construction (actuator), like conveyor's (5) driving roll (5a). Also the rotor can be formed as a shell of pulley (4) which is part of a vacuum belt conveyor comprising a stationary vacuum box (11), the rotor drive further comprising: said non-rotatory shaft (1) being supported by at least one supporting bracket (8) which is connected to the vacuum box. The object of this invention is also the method for corresponding purpose.

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## Construction and method in electric motor drive

The object of this invention is the construction in  
5 electric motor drive, where an asynchronous motor, such  
as drum motor or similar motor, which has a stator  
mounted on a non-rotatory shaft and around the stator  
is a rotor, which is rotatory, like by means of  
bearings, connected on the same shaft and has a short-  
10 circuit arrangement, is arranged to drive a machine  
construction (actuator).

Above described types of asynchronous, compact drum  
motors have been presented for example in publications  
15 EP 0 582 563,  
US 4,868,436 and FI 811414. Among these, the first-  
mentioned solution is carried into effect by keeping  
separate and individual copper short-circuit bars in  
their position by pressing them in place with collars  
20 mounted on the end flanges of the motor.

The disadvantage of this type of solution is the poor  
heat transmission from the short-circuit bars to the  
rotor shell. Further in the solution of US-patent  
25 4,868,436 the rotor structure is built up of so called  
active part i.e. electric plate package and at least  
two separate rotor shell parts i.e. support flange and  
onto it by means of screw coupling connected rotor  
shell, which makes the solution in question  
30 unnecessarily complicated. In application publication  
EP 0 617 155 there is a much similar solution (of above  
mentioned U.S.-patent), where motor's rotor package,  
which is constructed/laminated of electric plates, is

connected together with it's short-circuiting  
conductors to drum roller by means of screw/press  
coupling, which operates as a roll surface. Also this  
solution is disadvantageous especially in  
5 manufacturing. Further in latter Finnish patent  
application is presented a drum motor, which is  
designed especially for

elevator purposes. In this solution a separate roller  
10 with cable grooves and brake surface area for  
elevator's lifting cables and brakes is mounted on the  
upper shell of the rotor. E.g. in this solution is  
additionally proposed that the motor cooling is taken  
care of by machining radial ventilation holes in the  
15 roller and stator and to blow the cooling air to the  
holes with a separate blower.

To all of the above mentioned solutions it is common,  
that first of all respectively used machine  
20 construction (actuator)'s connection to the drum motor  
requires special mounting arrangements and/or extra  
parts for it i.e. a separate drive roll to be assembled  
on to an electrical motor's rotor (EP 0 582 563), a  
firmly assembled flange arrangement on the motor's  
25 frame (US 4,868,436) or a shell to be assembled outside  
the drum motor (FI 811414 and  
EP 0 617 155 A1). On the other hand in the motor  
constructions in the above mentioned innovations the  
cooling circulation is carried out by traditional  
30 means, thus it is not possible to reach higher outputs  
than with standard drum motor solutions.

The purpose of the construction of this invention is to overcome the above-described disadvantages and thereby essentially improve the level of the technique in this area. It is principally distinctive to the construction according to this invention, to carry out this purpose, that the functional part of the machine construction (actuator), like conveyor's driving roll or similar, is arranged to operate by having short-circuit arrangement as the rotor of the asynchronous motor. In other words: the "actuator" (e.g. driving roll) is formed to constitute itself the rotor of the asynchronous motor, with the actuator comprising the short-circuit arrangement.

The construction according to the invention is characterized by that the functional part of the machine construction (actuator), like conveyor's driving roll, is arranged to operate by having short-circuit arrangement as the rotor of the asynchronous motor.

It should be noted that the term "actuator comprising the short-circuit arrangement" is referring to many various (or different) embodiments. In the most simple embodiment, the actuator is formed as a one-piece solid roll shell being free from short-circuit bars and rings (also being free from laminated elements).

In another embodiment (also being free from laminated elements) short-circuit bars and rings are provided. Each of the bars and the rings will be located within the roll shell, preferably with a tight or positive fit

(or locking) being provided between each bar and the roll shell, whereby additional mounting elements (e.g. collars and/or screws) are no more needed.

- 5 The most important advantages of the construction of this invention is the simplicity of its construction, manufacturing and usage, efficiency and reliability of working, which attain the most possible integrated and compact machine configuration, which allow to get
- 10 higher output and higher torque from the used asynchronous massive rotor and significantly to improve its performance in other ways too. The simplicity of the construction of this invention as advantageous solution is based e.g. on fact there is no need to use
- 15 traditional short-circuiting conductors, as the short-circuit arrangement is established directly into the functional part of the machine construction (actuator), like conveyor's driving roll. On the other hand the structure of
- 20 this invention makes it possible to use the traditional short-circuiting connectors in a new way, so that they are located essentially internally on a functional part of the machine construction (actuator) as the rotor shell, like conveyor's driving roll. When applying
- 25 advantageously the structure of this invention, the asynchronous motor is equipped with primary and secondary cooling circulation to cool both the stator and the rotor for example so that the cooling fluid is firstly essentially carried through the stator shaft
- 30 and with the help of the holes in the shaft elsewhere as parallel flow through the flow system in the rotor shell. As a further improvement the rotor is manufactured of electric conductive compound metal

structure, where copper short-circuit bars or pipes and rings are for example explosion welded into pre-drilled/machined holes/slots. On the other hand during manufacturing of the asynchronous motor it is possible  
5 to utilize also a casting technique.

Further advantageous solution is to assemble the stator on the hollow shaft/pipe also working as stator shaft, which is used for example to feed over-pressure cooling  
10 air. Herewith it is effectuated a hermetic primary cooling, which is known from EP 0 617 155 and which prevents dirt to penetrate into the drum motor, which is not possible to prevent with the conventional effectuated freely (open) breathing air-cooled  
15 solutions. Further advantageous feature is that the short-circuit hollow bars or pipes are positioned within the rotor shell, functioning as secondary cooling channels. Thereby it is possible to carry the cooling air to the hottest spots of the rotor, which  
20 helps in its way significantly both to obtain the maximum output and to increase the amount of starts/stops of the machine construction (actuator) equipped with the motor in question.

25

The advantageous solutions of the structure of the invention have been presented in separate independent patent claims.

30

Object of this invention is also a method for equivalent purpose, which is more specifically described in independent patent claim's introduction



section and whose characteristic features in corresponding patent claim's characteristic section.

The method according to the invention is characterized  
5 by that the functional part of the machine construction (actuator), like conveyor's driving roll, is arranged to operate by having short-circuit arrangement as the rotor of the asynchronous motor.

10

One of the most important advantages the method of this invention has, is the simplicity of the operating principle and the simple constructions which makes it possible and the reliability of working and which  
15 allows to gain the utmost compact machine construction (actuator) unit with integrally united asynchronous motor to achieve high mechanical load capacity, vibration strength and high starting and operation torque features. The simplicity of the method of this  
20 invention as a advantageous solution is based for example on the fact that there is no need to use a separate laminated rotor component with traditional short-circuiting conductors inside a functional part of the machine construction, by establishing a short-  
25 circuit arrangement directly into the functional part of the machine construction (actuator), like conveyor's driving roll. On the other hand the method of this invention makes it possible to use the traditional short-circuiting connectors in a new way, so that they  
30 are located essentially internally on a functional part of the machine construction (actuator) as the rotor shell, like conveyor's driving roll.

Furthermore as an advantageous development of this innovation, it is possible to increase an air gap diameter between stator and rotor once a maximum outer diameter and total length of a drum motor is limited. Thus by this innovative design it is possible to get higher output power and higher torque compared to an asynchronous drum motor having same main dimensions as this new innovative drum motor construction and having a standard laminated rotor component inside a rotor shell.

Furthermore as an advantageous development of this method is to minimize the manufacturing costs of the here mentioned massive motor for example by manufacturing the rotor and the associated slots by casting them of steel.

Applying the method advantageously the asynchronous motor is being cooled effectively to get higher output than with conventional ones can be reached, because correctly carried out i.e. according to this invention realized for example hermetic and essentially in axial direction through the asynchronous motor carried cooling fluid flow makes it possible for example to direct the over-pressure cooling air to the hottest spots of the rotor, which is an essential condition both to increase the maximum output and to increase the amount of starts/stops. On the other hand compared to the freely breathing air-cooled solutions this solution prevents especially in hard conditions filth to penetrate into the drum motor structure.

Cooling of asynchronous motor with a solid rotor can be realised either with or without a secondary cooling arrangement via hollow bars or tubes inside a functional part of the machine construction (actuator) as the rotor shell. In such constructions the cooling is taken care of only with a primary cooling arrangement (e.g. air flow arrangement through an air gap between an inner surface of rotor shell and an outer surface of stator component.

Furthermore it is important that the short-circuit bars and rings belonging advantageously to the short-circuiting adjustment are arranged essentially integral with rotor shell i.e. at least partly or then totally with internal arrangements, and thus also a much more efficient heat conduction than present, between the steel shell and the copper short-circuit bars and rings can be accomplished than with the traditional solutions. This also gives better possibilities for higher output and to increase the starts and stops of the asynchronous motor within a certain time interval.

Advantageous solutions of the method of the invention have been presented in separate independent patent claims.

The invention is in more detail presented in the description and the attached drawings.

Figure 1 presents

a longitudinal cross section of a typical machine construction (actuator) unit, which is accomplished with the method in this invention and

5

Figure 2 presents

a cross-profile of spots Fig 2 - Fig. 2. in Figure 1.

10 

Figures 3a - 3C present

some alternative massive motor constructions of a drum motor.

Figures 4 and 5 present

15

a drum motor designed according to the invention and integrated to one end of a vacuum belt conveyor construction, with Fig. 5 being a section along line V - V of Fig. 4.

20 Referring to Figures 1 to 3, the object of this invention is a construction in electric motor drive, where a so called solid asynchronous motor, which has a stator 2 mounted on a non-rotatory shaft 1 and around the stator is a rotor 4, which is, like by means of

25 bearings 3, rotary connected on the same shaft 1 and has a short-circuit arrangement, is designed to drive a machine construction (actuator). The functional part of the machine construction (actuator), like conveyor's 5 driving roll 5a or 5b or 5c is designed to operate by

30 integrally connected short-circuit arrangement as the rotor 4 of the asynchronous motor. Especially in Figure 3c is shown the most simple structure of the invention, in which conveyor's driving roll 5a is realized with a

solid shell, which operates directly as the short-circuit arrangement of the rotor 4 without any traditional laminated rotor component with short-circuit conductors (e.g. short-circuit bars and rings).

5 The solution according to this principle is also shown in Figure 3b, where driving roll 5b is designed to operate as the rotor of the asynchronous motor with the solid shell having on its inner surface drilled or machined holes or grooves.

10

Different from Figures 3b and 3c, the invention may be advantageously used in connection with the structure, where the short-circuit arrangement can be realized in the rotor's shell 4a with short-circuiting conductor  
15 bars 4b and rings 8. In this connection short-circuiting connector bars 4b and rings 18 are arranged to operate at least partly internally of

the rotor's shell 4a operating as functional part of  
20 the machine construction (actuator), such as conveyor's driving roll 5c. This type of solutions are presented especially in Figure 2, where round short-circuit bars 4b are being used and in Figure 3a where quadrangular short-circuit bars 4b' are being used in rotor shell  
25 4a'. The bars 4b shown in Figure 2 may be hollow, so that each bar comprises a channel 4c for piping cooling fluid. At each end of shell 4a, a flange 7 is provided which connects the shell to one of the bearings 3.

30 In Figure 3a is shown a design, where conveyor's driving roll 5a is realised by a solid shell having quadrangular short-circuit bars on its inner surface. This type of electrical motor design should be used

when a compact drum motor constructions (e.g. maximum outer diameter and total length of the drum motor are limited) with high output power and torque are desired. Such a compact drum motor is needed in vacuum belt conveyors used for "tail threading" in paper machines.

A typical design of drum motor's stator component 2 consists typically a pile of 0,3 - 1,0 mm thick electrical sheets 21 which are mounted on a stationary hollow shaft 1 and fixed at their position by spot welding stator end plates 20 to the stationary shaft. Stator windings 6 are connected via electrical connection cable 19 to an external electric grid.

Figures 4 and 5 show one end of a vacuum belt conveyor comprising an endless air pervious belt 10 which - in operation - travels across two rotary pulleys, only one pulley 4 being shown. The pulleys are supported by a vacuum box 11. Therein a negative pressure will be created by any vacuum source (not shown). The negative pressure will propagate through openings 12 of a cover plate 13 and through belt 10 in

order to convey a web of paper or similar material, in particular a lead strip or "tail" which has been separated from threading purposes (see e.g. US patent 3,355,349).

In order to drive the belt 10, a pulley 4 is designed as the rotor of an electric motor drive according to the present invention. Similar to Figure 1, a stationary hollow shaft 1 supports a stator 2 and (by means of bearings 3) the rotor 4, - which is the pulley

of the vacuum belt conveyor - and which again comprises a rotor shell 4a and two end-flanges 7.

Preferably, the following measures may be provided in order to adapt the electric motor drive to the demands of a vacuum belt conveyor:

The width W of conveyor 5 (and also the length L of the pulley's shell 4a should be relatively small, about 0,25 m. The pulley's diameter should preferably be less than 0,15 m. On the other hand, the speed of the belt should be about the same as the operating speed of modern paper machines which may exceed 2000 m/min. Therefore, there is a need for very high motor output while the dimensions of the motor drive should be relatively small.

To fulfil these demands, the distance D between the bearings 3 is larger than the length L of the pulley's shell 4a, in order to increase the internal space being available for stator 2 and for the short-circuit arrangement of the rotor 4. As a consequence, each flange 7 is formed as a bushing which bridges the difference between length L and distance D.

Furthermore, each of the supporting brackets 8 which connect the stationary shaft 1 to the side walls of the vacuum box 11 is formed similar to a Z (in other words: it is "double

folded"). In addition, each support bracket 8 may be wrapped around the periphery of one of the flanges 7.

In order to improve the cooling effect, the hollow shaft 1 comprises at one of its ends an internal (e.g. coaxial) supply channel (15) as well as a discharge channel 16, as a result, all the cooling fluid X must  
5 pass the inner side of stator 2 as well as its outer side and the inner side of the rotor (plus the channels 4c, if existing, in the bars 4b in Figure 1).

Also, the following is advantageous: The above  
10 mentioned supporting brackets 8 can be used also as a connection surface for vacuum belt conveyor's accessories (e.g. knife plates, rotary rippers and choppers) (which is not shown as practical solution in enclosed drawings).

15

In addition to the things mentioned above, the cooling of the machine construction (actuator) operating as a rotor of a asynchronous motor is realized advantageously mainly with primary cooling by carrying  
20 over-press cooling air X in axial direction through the stator shaft 1, which can be for example a hollow shaft, pipe or similar and it is equipped with it's first flow arrangement 1a. On the other hand when using advantageously the structure of this invention it is  
25 possible to boost the cooling of the asynchronous motor besides what was described earlier or instead of it also with secondary cooling by equipping the short-circuiting bars 4b' with another flow arrangement 4c. Then, for example, it is possible to carry cooling air  
30 X in axial direction through the hollow copper short-circuit bars 4b, for example, according to the principle in Figure 1 with the help of the holes 1b in the stator shaft 1 together with the primary air flow



1a which take place together with the parallel flow to the hottest sports of the rotor, which helps to get higher output from the machine construction (actuator) and especially  
5 to improve to carry the short run starts/stops.

Once an asynchronous motor has a solid rotor's cross section as shown in Figures 3a, 3b and 3c, cooling is taken care of an air flow arrangement through an air  
10 gap which locates between an inner surface of a rotor shell 5a, 5b, 5c and an outer surface of stator component 2.

Further advantageous solution of the structure of the  
15 invention is to manufacture the rotor of electric conductive compound metal structure, where copper short-circuit bars 4b; 4b' are integrally connected to the steel rotor shell 4a; 4a' for example by explosion welding or by centrifugal casting.

20 It is possible with the asynchronous motor realized according to the invention when using especially star type coupling for windings, to get the output of the drum motor equipped with three, four, or six pole  
25 stator windings always reach the level 0,5 - 500 kW and to have the speed of rotation typically in the area of 0 - 20000 rpm.

As a further advantageous development (which is not  
30 shown in enclosed drawings) it is advantageous to benefit the frequency transformer used by the asynchronous motor, which is equipped with active rotation speed control. In this connection rather

traditional solutions can be used to achieve the wanted effect.

The object of this invention is also a method with an electric motor drive, where the machine construction (actuator) is used by a asynchronous motor, such as drum motor, which has a stator 2 mounted on a non-rotatory shaft 1 and around the stator is a rotor 4, which is rotatory, like by means of bearings 3, connected on the same shaft 1 and has a short-circuit arrangement. The functional part of the machine construction (actuator), like conveyor's 5 driving roll 5a, is arranged to operate by having short-circuit arrangement as the rotor 4 of the asynchronous motor (typical constructions shown in Figures 2 and 3a). The method according to this principle is applied in simplest way for example in constructions in Figure 3b, wherein driving roll's 5b machined grooves/slots 5d are arranged as the short-circuit arrangement. On the other hand in Figure 3c is a similar type of solution without traditional short-circuit bars, wherein the driving roll 5a is realized a solid shell, which operates directly as the short-circuiting arrangement.

Furthermore as an advantageous application of this method it is advantageous to benefit it with asynchronous motor, whose short-circuit arrangement is connected to the rotor 4, like short circuiting bars 4b and rings 8 are supported on rotor's shell 4a. In this connection short-circuit bars and rings belonging to the short-circuit arrangement are arranged to operate at least partly internally as the rotor's 4 shell 4a of the operating functional part of the machine

construction (actuator), such as conveyor's driving roll 5a. In this connection this type of solution is presented, especially in Figure 2, showing round short-circuit conductors 4b and further in Figure 3a showing  
5 quadrangular short-circuit bars 4b'.

Furthermore referring to Figure 1 this method can be used with an asynchronous motor which is arranged to be cooled by having a fluid flow. The cooling of the  
10 asynchronous motor is realized as a closed system by carrying cooling fluid, such as over-pressure cooling air X, hermetically essentially in axial direction in a primary flow arrangement 1a through the stator shaft 1 like hollow shaft, pipe or similar. On  
15 the other hand the cooling of the asynchronous motor can be arranged instead of as described above by carrying cooling fluid, such as over-pressure cooling air X hermetically essentially in axial direction in a secondary flow arrangement 4c provided in short-circuit  
20 conductors 4b like hollow bars or pipes.

Especially referring to Figure 1, as an example: Rotor 4 of the solid asynchronous motor is manufactured of electric conductive compound metal structure, when  
25 advantageously, for example, copper short circuit bars 4b which are welded, like explosive welded or butt welded into the holes in the steel rotor shell 4a or that they are cast integral with a most suitable casting method, like press casting method (solution is  
30 not presented in Figure 1). With above mentioned methods every short-circuit bar 4b and ring 18 is integrated as an integral part of rotor shell 4a, which allows to achieve better heat transmission between the

steel shell and copper short-circuit conductors. This fact has a great importance when trying to get higher maximum power from the machine constructions (actuators) than with traditional solutions and especially when short run starts/stops are in question. The same is true with the embodiment shown in Figure 3a comprising rotor shell 4a' and bar 4b'.

It is obvious that this invention is not limited to the above mentioned or explained solutions, it can be considerably modified within it's basic idea. Thereby it is possible firstly to utilize the construction or arrangement of this invention in most different connections, whereupon the dimensions and constructions can considerably differ from the hereby presented example drawings. On the other hand other type of fluids can be used in the cooling of the asynchronous motor realized according to the invention or the cooling can be done differently from what presented above.

Claims

1. A construction in electric motor drive,  
5 where an asynchronous motor, such as drum motor,  
which has a stator (2) mounted on a non-rotatory  
shaft (1), and around the stator is a rotor (4),  
which is rotatory, like by means of bearings (3),  
connected on the same shaft (1) and has a short-  
10 circuit arrangement, is designed to drive a machine  
construction (actuator), characterized in that the  
functional part of the machine construction  
(actuator), like conveyor's (5) driving roll (5a,  
5b, 5c), is arranged to operate by having short-  
15 circuit arrangement as the rotor (4) of the  
asynchronous motor.

2. The structure as claimed in claim 1,  
wherein the short-circuit arrangement is established  
20 by the short circuiting bars (4b, 4b') and rings  
(18) supported on the rotor's shell (4a, 4a'),  
characterized in that the short-circuiting bars (4b,  
4b') and rings (18) belonging to the short-circuit  
arrangement are arranged integral with the rotor's  
25 (4) shell (4a, 4a'), which is a functional part of  
the machine construction (actuator), like conveyor's  
driving roll (5).

3. The structure as claimed in claim 1 or  
30 claim 2, wherein an asynchronous motor is arranged  
to be cooled by having a fluid flow, characterized  
in that the cooling of the asynchronous motor is  
realized in a closed system, by carrying cooling

fluid, such as over-press cooling air (x)  
hermetically essentially in axial direction with  
it's primary flow arrangement (1a) through the  
stator shaft (1) like hollow shaft or pipe and/or  
5 with secondary flow arrangement (4c) through short-  
circuit conductors (4b ) like hollow bars or pipes.

4. The structure as claimed in any of the  
claims 1-3, characterized in that the rotor (4) of  
10 the solid asynchronous motor comprises an of  
electric conductive compound metal manufactured  
structure, preferably comprising copper short  
circuit conductors (4b, 4b'), which are welded by  
explosive welding, butt welding into the holes in  
15 the steel rotor shell (4a, 4a') or that they are  
cast integral with the rotor shell in their places  
by a suitable casting method (e.g. centrifugal  
casting method).

20 5. The structure as claimed in any of the  
claims 1-4, characterized in that that when using  
especially star type coupling for windings, the  
output of the asynchronous motor equipped with  
three, four, or six pole stator windings is 0,5 -  
25 500 kW having speed of rotation 0-20 000 rpm.

6. The structure as claimed in some of the  
claims 1-5, characterized in that the asynchronous  
motor is having a frequency transformer drive, which  
30 is equipped with an active rotation speed control.

7. The structure as claimed in some of the  
claims 1-5, characterized in that the rotor is

formed as a shell of a pulley (4) which is part of a vacuum belt conveyor (5) comprising a stationary vacuum box (11), the rotor drive further comprising: said central shaft (1) being supported by at least  
5 one supporting bracket (8) which is connected to the vacuum box (11).

8. The structure as claimed in some of the claims 1-7, characterized in that the drum motor's  
10 supporting brackets (8) can be used also as a connection surface(s) of the vacuum belt conveyor's accessories (e.g. knife plates, rotary rippers and choppers).

15 9. The structure as claimed in claim 7, characterized in that the distance D between the bearings (3) supporting the pulley (4) is larger than the length L of the pulley's shell (4a).

20 10. The structure as claimed in claim 9, wherein each flange (7) which connects an end of shell (4a, 4a') to one of the bearings (3) is formed as a bushing which bridges the distance between length L and D.

25 11. The structure as claimed in claim 9, wherein each supporting bracket (8) - seen in a longitudinal section of the conveyor (5), in Figure 5 - is formed double-folded similar to a Z.

30

12. Method for electric motor drive, where a machine construction (actuator) used by an asynchronous motor, such as drum motor, which has a

stator (2) mounted on a non-rotatory shaft (1) and  
around the stator is a rotor (4), which is rotatory,  
like by means of bearings (3), connected on the same  
shaft (1) and has a short-circuit arrangement,  
5 characterized in that the functional part of the  
machine construction (actuator), like conveyor's (5)  
driving roll (5a), operates by having short-circuit  
arrangement as the rotor (4) of the asynchronous  
motor.

10

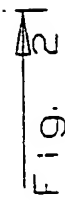
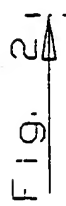
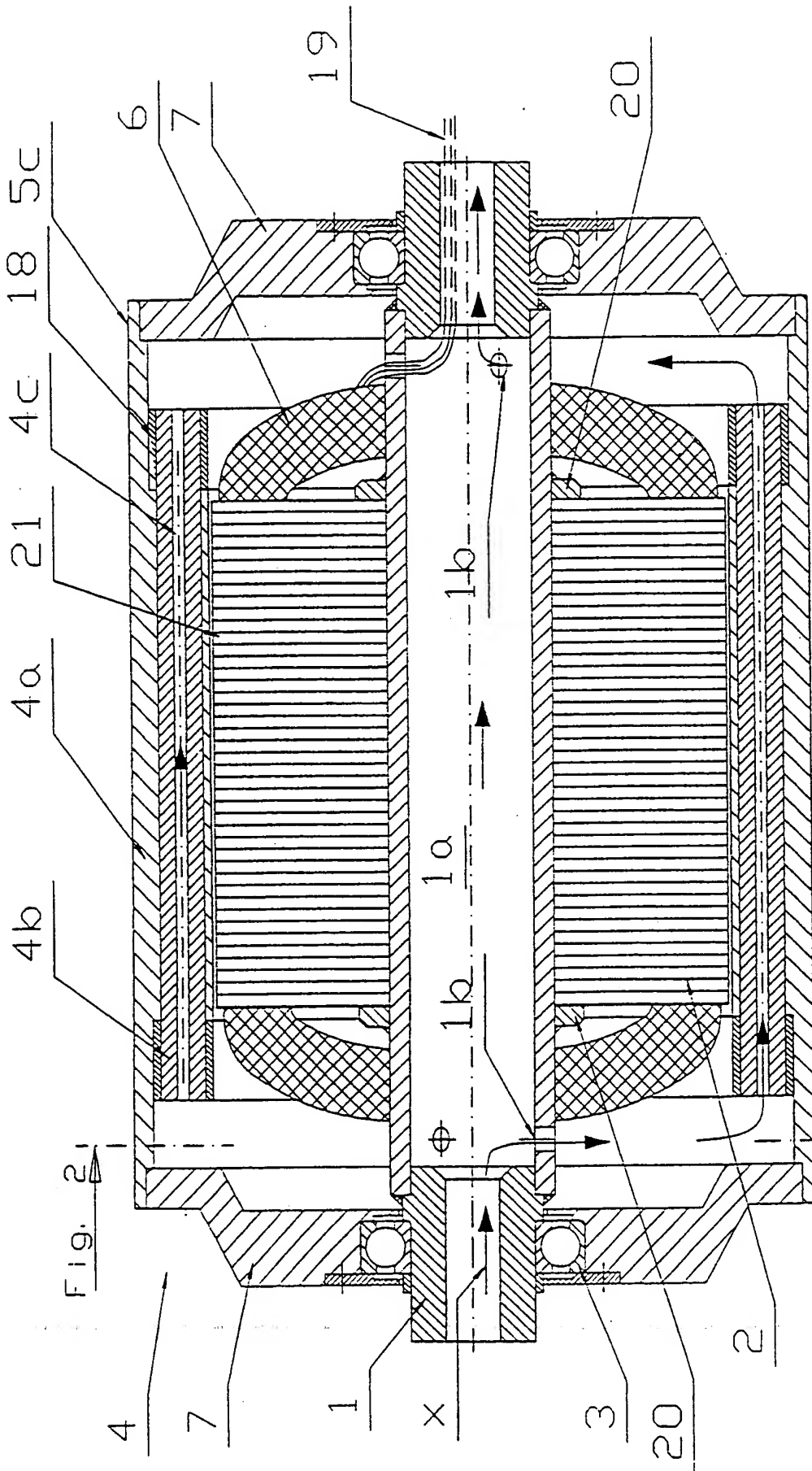
13. Method as claimed in claim 12 with  
asynchronous motor, where the short-circuit  
arrangement is realized in connection with the  
rotor (4) like having short-circuit conductor bars  
15 (4b, 4b') and rings (18) supported on the rotor's  
shell (4a), characterized in that to the short-  
circuit arrangement operate at least partly  
internally as the rotor's (4) shell (4a, 4a') of the  
operating functional part of the machine  
20 construction (actuator), such as conveyor's driving  
roll (5a, 5b, 5c).

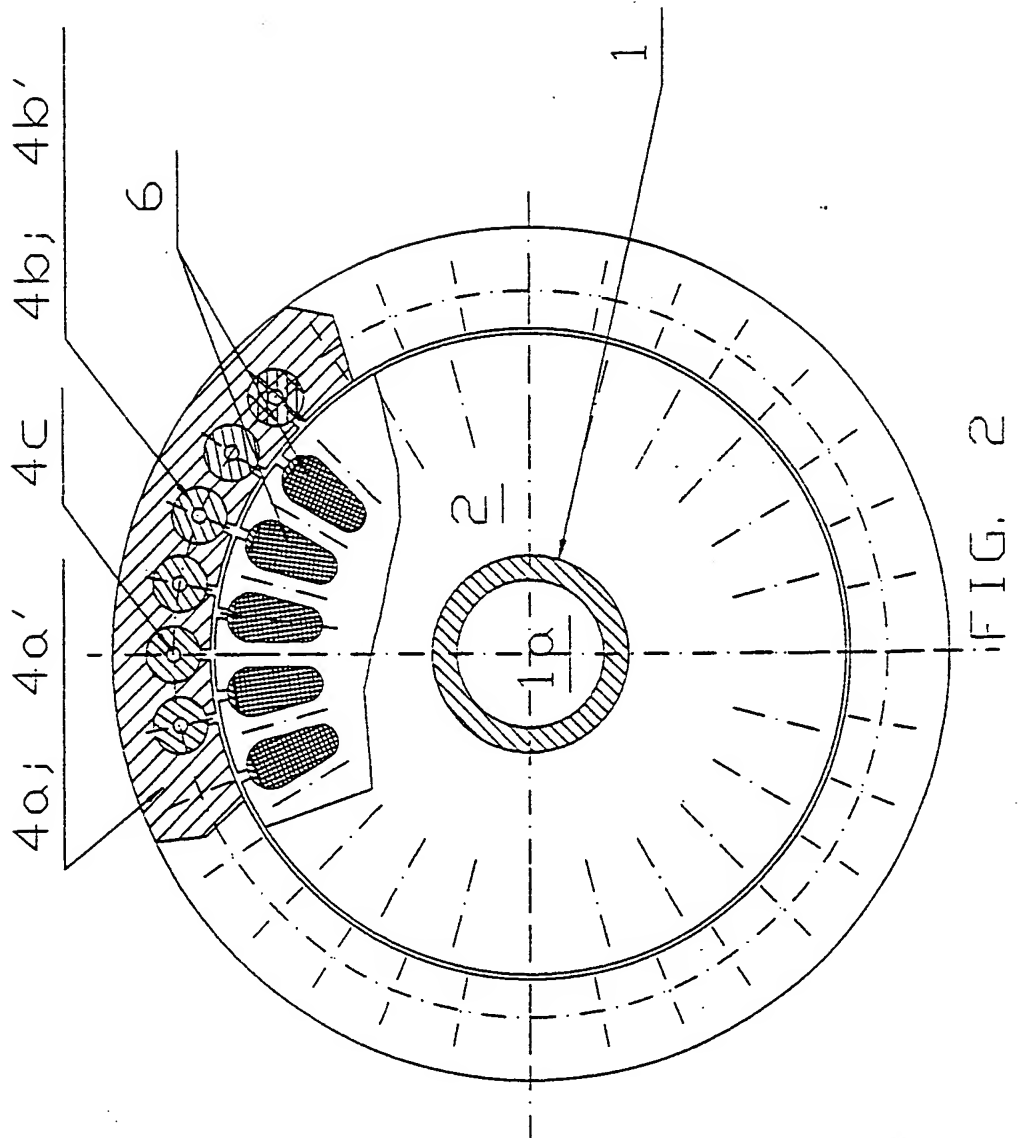
14. Method as claimed in claim 12 or 13  
wherein a asynchronous motor is cooled by having a  
25 fluid flow, characterized in that the cooling of the  
asynchronous motor is realized as closed by carrying  
cooling fluid, such as over-pressure cooling air (x)  
hermetically essentially in axial direction with  
it's primary flow arrangement (1a) through the  
30 stator shaft (1) like hollow shaft or pipe and/or  
through with secondary flow arrangement (4c)  
equipped short-circuit conductors (4b') like hollow  
bars or pipes.



15. Method as claimed in some of the claims  
12-14, characterized in that the rotor (4) of the  
solid asynchronous motor is manufacture of electric  
5 conductive compound metal structure, whenupon most  
suitable are copper short circuit conductors (4b,  
4b'), which are connected into the holes and/or  
grooves by welding, like explosive welding or butt  
welding in the steel rotor shell (4a, 4a') or that  
10 they are cast integral within the rotor by a  
suitable casting method, like centrifugal casting  
method.

16. Method as claimed in some of the claims  
15 12-15, characterized in that the rotor is formed as  
a shell of a pulley (4) which is part of a vacuum  
belt conveyor (5) comprising a stationary vacuum box  
(11), the rotor drive further comprising: said  
central shaft (1) being supported by at least one  
20 supporting bracket (8) which is connected to the  
vacuum box (11).





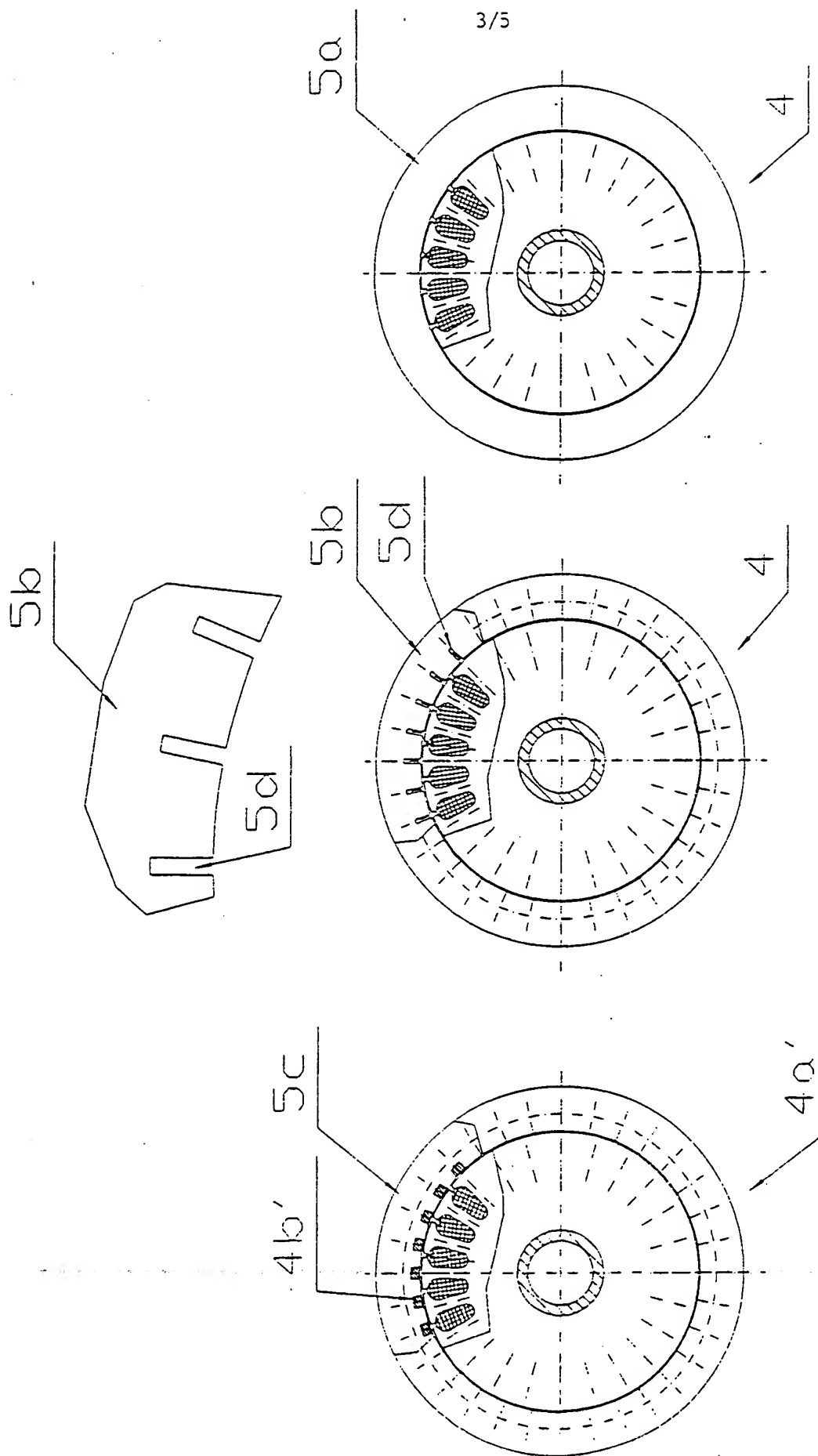


Fig. 3a

Fig. 3b

Fig. 3c

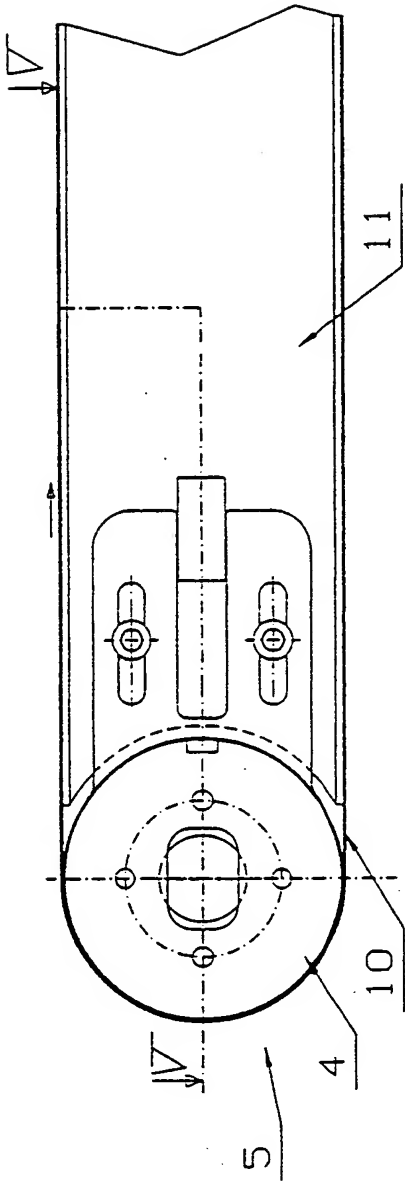
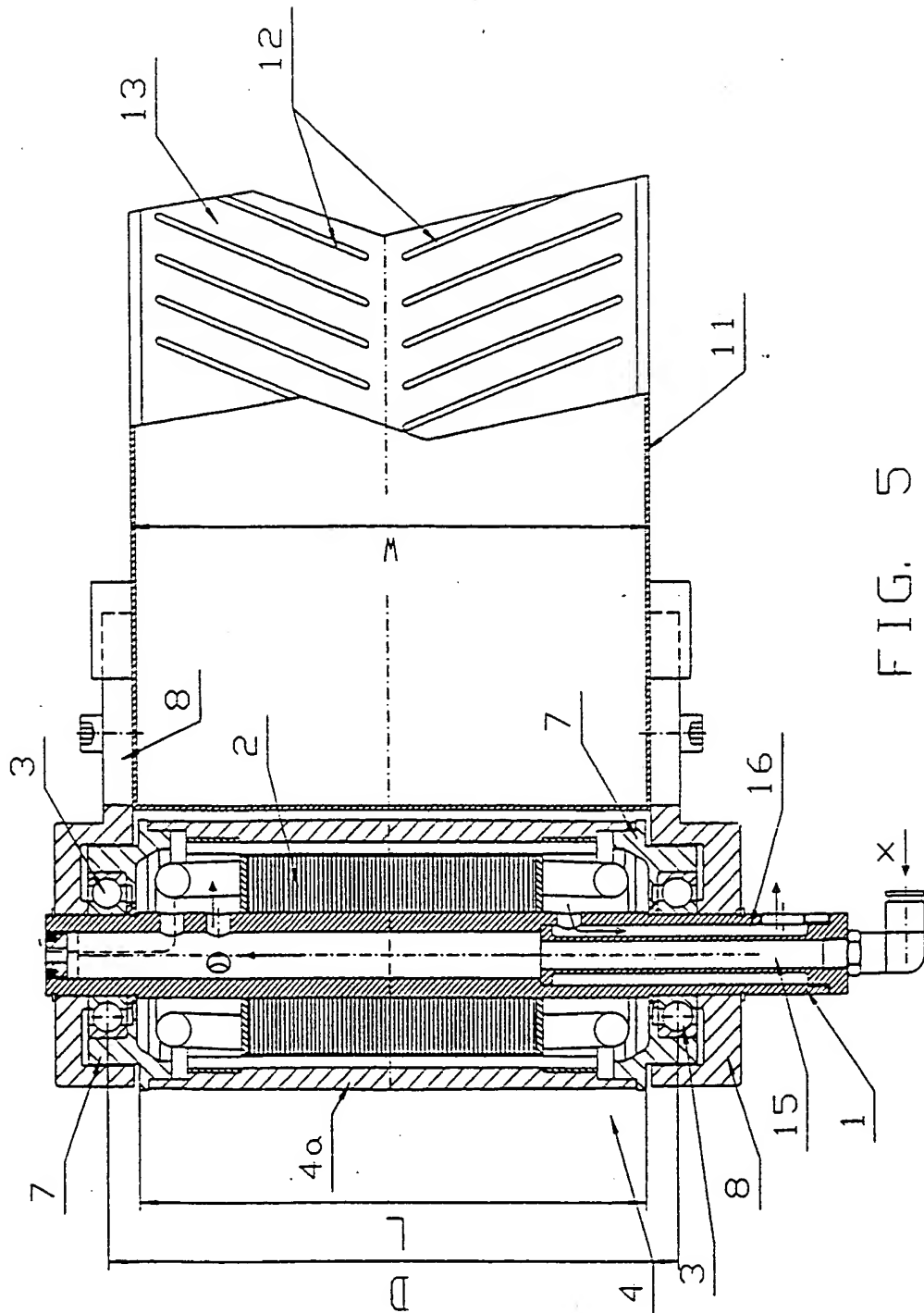


FIG. 4



PCT/USA NATIONAL DECLARATION AND POWER OF ATTORNEY  
FOR U.S. PATENT APPLICATIONS  
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
UNDER 35 U.S.C. SECTION 371(c)(4)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name:

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the invention described and claimed in international application No. PCT/FI00/00990 entitled: CONSTRUCTION AND METHOD OF AN ELECTRIC MOTOR DRIVE, and as amended on \_\_\_\_\_ (if any), which I have reviewed, and I understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above and for which I solicit a patent; that I do not know and do not believe that this invention was ever known or used in the United States of America before my or our invention or discovery thereof, or patented or described in any printed publication in any country before my or our invention or discovery thereof, or more than one year prior to my international application; that this invention was not in public use or on sale in the United States of America for more than one year prior to my international application; that this invention has not been patented or made the subject of an inventor's certificate issued before the date of my international application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months before my international application; that I acknowledge my duty to disclose information of which I am aware which is material to the examination of this application; and that prior to filing said international application, applications for patent or inventor's certificate on this invention or discovery which have been filed by me or my legal representatives or assigns in any country foreign to the United States of America are as follows:

(a) none filed more than 12 months prior to said international application, unless named below:

(b) earliest filed less than 12 months prior to said international application (the priority of which is hereby claimed under 35 U.S.C. Section 365):

FI 19992456, filed November 16, 1999.

I hereby claim the benefit under Title 35, United States Code, §120, of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a), which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.)

(Filing Date)

(Status)(patented, pending, abandoned)

I hereby appoint: Todd T. Taylor, Reg. No. 36,945; Ronald K. Aust, Reg. No. 36,795; Keith J. Swede, Reg. No. 43,176; Max W. Garwood, Reg. No. 47,539 and Jeffrey T. Knapp, Reg. No. 45,384, of the firm of TAYLOR & AUST, P.C., as attorney(s)/patent agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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FAX: 219-857-9300

I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Inventor's Signature: V. SeinuDate: 02.07.2001

## PCT REQUEST

992456/JS

Original (for SUBMISSION) - printed on 13.11.2000 03:29:51 PM

0	For receiving Office use only	
0-1	International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and "PCT International Application"	
0-4	Form - PCT/RO/101 PCT Request Prepared using	PCT-EASY Version 2.91 (updated 10.10.2000)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	National Board of Patents and Registration (Finland) (RO/FI)
0-7	Applicant's or agent's file reference	992456/JS
I	Title of invention	CONSTRUCTION AND METHOD IN ELECTRIC MOTOR DRIVE
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	MISCEL OY
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III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
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III-1-6	State of nationality	<del>FI</del> RU
III-1-7	State of residence	FI



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IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	common representative
IV-1-1	Name	MISCEL OY
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IV-1-3	Telephone No.	+358-400-268 917
IV-1-4	Facsimile No.	+358-3-3141 0041
V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<p>AP: GH GM KE LS MW MZ SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT</p> <p>EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT</p> <p>EP: AT BE CH&amp;LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE TR and any other State which is a Contracting State of the European Patent Convention and of the PCT</p> <p>OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT</p>
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<p>AE AG AL AM AT (patent and utility model) AU AZ BA BB BG BR BY BZ CA CH&amp;LI CN CR CU CZ (patent and utility model) DE (patent and utility model) DK (patent and utility model) DM DZ EE (patent and utility model) ES FI (patent and utility model) GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK (patent and utility model) SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW</p>

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V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI-1	Priority claim of earlier national application	
VI-1-1	Filing date	16 November 1999 (16.11.1999)
VI-1-2	Number	19992456
VI-1-3	Country	FI
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1
VII-1	International Searching Authority Chosen	European Patent Office (EPO) (ISA/EP)
VIII	Check list	number of sheets      electronic file(s) attached
VIII-1	Request	4      -
VIII-2	Description	17      -
VIII-3	Claims	5      -
VIII-4	Abstract	1      992456.txt
VIII-5	Drawings	5      -
VIII-7	TOTAL	32
	Accompanying items	paper document(s) attached      electronic file(s) attached
VIII-8	Fee calculation sheet	✓      -
VIII-9	Separate signed power of attorney	✓      -
VIII-16	PCT-EASY diskette	-      diskette
VIII-17	Other (specified):	Copy of the first Official Action      -
VIII-18	Figure of the drawings which should accompany the abstract	Fig. 1
VIII-19	Language of filing of the international application	English

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IX-1	Signature of applicant or agent	
IX-1-1	Name	MISCEL OY
IX-1-2	Name of signatory	Jaakko Säiläkivi
IX-1-3	Capacity	Managing Director

## FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/EP
10-6	Transmittal of search copy delayed until search fee is paid	

## FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	
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A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 H02K7/10 //B65G23/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 H02K B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)  
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 771 197 A (IVANTO OSMO ET AL) 13 September 1988 (1988-09-13)  column 1, line 54 -column 2, line 21; figure 1	1,2, 4-13,15, 16
A	---	3,14
A	US 5 918 728 A (SYVERSON CHARLES D) 6 July 1999 (1999-07-06) column 1, line 9 - line 61 column 3, line 43 - line 61	1-16
A	---	
A	DE 297 17 062 U (BDL MASCHINENBAUGESELLSCHAFT M) 18 December 1997 (1997-12-18) page 2, line 1 -page 3, line 13 page 4, line 25 - line 33 -----	1-16

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

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- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
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Date of the actual completion of the international search

12 April 2001

Date of mailing of the international search report

07.05.01

Name and mailing address of the ISA

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Authorized officer

T. Erlandsson/MN

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/FI 00/00990

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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			DE 3216978 A	25-11-1982
			FR 2505574 A	12-11-1982
			GB 2101814 A	19-01-1983
			JP 57206255 A	17-12-1982
			SE 453785 B	29-02-1988
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